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Electrodialytic separation of phosphorus and heavy metals from sewage sludge ash

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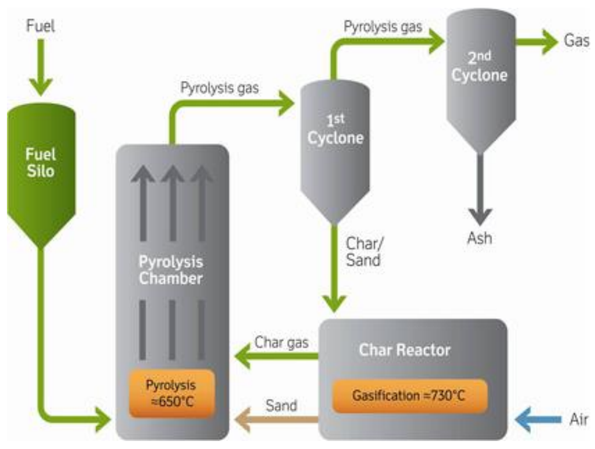
Phosphorous –Some facts

- Phosphorous is a limited resource and an **essential nutrient**.
- Phosphate rock (P-rock) reserves are foreseen to be **depleted in 300-400 years** [1].
- In the last decade, the **EU imported around 90 % of the P-rock** that it consumed (IFA).
- In the EU there is a flow of 182,000 t of **non-recycled P yearly from sewage sludge**, around 20% of the EU P-rock consumption (Van Dijk et al. (submitted).
- A common practice in some countries (DE, NL, BE, AT, CH, US, JP, HK) is **incineration** of sewage sludge. In recent years, **gasification** has gained attention.

Low-temperature gasification technology

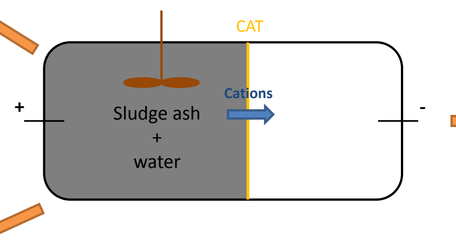


- Due to the low temperature it is possible to use high alkaline fuels. Examples: straw, sewage sludge, etc.
- The resulting ashes, might have a high content in heavy metals or have a poor P-plant availability

Electrodialysis: a technology to recover P from sewage sludge ashes

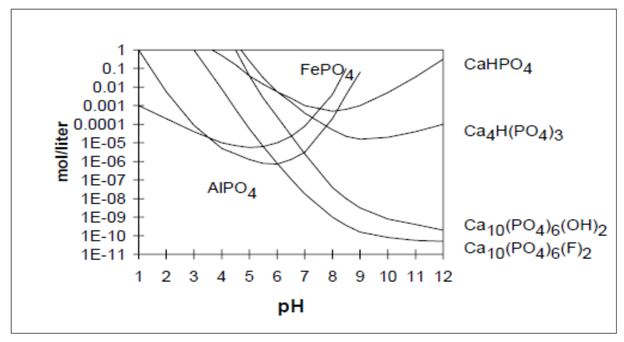
- A patent has been filed from DTU (WO 2015/032903) for the 2-compartment Electrodialytic (ED) cell.

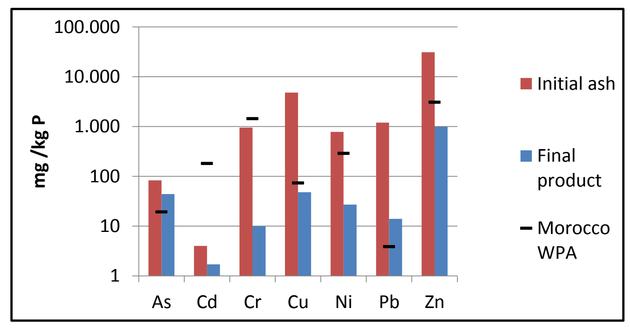
Anolyte liquid:
- P-rich
- Acidic (H^+ generated in the anode)
- Low in heavy metals



Catholyte liquid:
Mostly Ca and heavy metals

Bulk ash: can be reused in construction industry





- With this setup, it is possible to recover up to **90% of P from incineration sewage sludge ashes**, in the anolyte liquid with low content in heavy metals (Cd, Cr, Cu, Ni, Pb, Zn) [2].
- **Only 26% of P** was recovered with the same setup at the same conditions (liquid-to-solid ratio, current density and experimental time) with **gasification sewage sludge ashes** [3]. Most likely, due to the presence of **Fe-P bindings**. Poor results were previously observed for ashes with high Al content [4].
- **Up to 70% of P** was eventually recovered for the same ashes with an innovative ED setup. The recovered P-liquid has a content in heavy metals **comparable to the one of wet phosphoric acid**. The new setup is currently being drafted for a patent filing.
- Further work will focus on sewage sludge ashes containing both **high content of Fe and Al.**

References
[1] C.J. Dawson, J. Hilton, Fertiliser availability in a resource-limited world: Production and recycling of nitrogen and phosphorus, Food Policy 36 (Jan) (2011) S14–S22.
[2] B. Ebbers, L.M. Ottosen, P.E. Jensen, Comparison of two different electrodialytic cells for separation of phosphorus and heavy metals from sewage sludge ash, Chemosphere (2015)
[3] R. Parés Viader, P. E. Jensen, L. M. Ottosen, J. Ahrenfeldt, and H. Hauggaard-Nielsen, "Electrodialytic extraction of phosphorus from ash of low-temperature gasification of sewage sludge," Electrochimica Acta (2015).
[4] L.M. Ottosen, P.E. Jensen, G.M. Kirkelund, Electrodialytic Separation of Phosphorus and Heavy Metals from Two Types of Sewage Sludge Ash, Separation Science and Technology 49 (2014) 1910–1920.

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